REFOOTURE

from sustainability towards regenerative thinking

Guiding principles to support a transition towards Regenerative Inclusive Food Systems (RIFS)

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This is a working paper derived from a manuscript to be submitted to a peer-reviewed journal (O' Keeffe et al., in preparation). We prepared it in the frame of the REFOOTURE project (phase 2020-2023). The project aims to promote regenerative inclusive food systems in Eastern Africa through multi-stakeholder collaboration in living labs.

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How can a food system be guided towards its true potential of achieving multiple goals? What is in fact its direction? How to reach multiple intertwined goals, i.e., food and nutrition security and sovereignty, healthy ecosystems, decent livelihoods, and equality in caring communities? The RIFS principles have been developed to serve as a compass in this pursuit. And this compass is set to guide us towards regenerative inclusive food systems (RIFS). In this paper we demonstrate the need to rethink and redirect our food systems. We show different scholars' thoughts about the essence of regenerative approaches, where people and nature are treated as equal partners committed to caring for a particular place. We introduce our five principles towards RIFS to guide people in multi-stakeholder processes in East African living labs for RIFS. The principles are: (i) sense of place and purpose, (ii) socio-ecological design for innovation, (iii) building connections, (iv) fair, just and inclusive transitions, (v) design for renewal (it's a living process).

O' Keeffe[1] S., and M. Siegmund-Schultze[1]. 2022. **Guiding principles to support a transition towards Regenerative Inclusive Food Systems (RIFS)**. Wageningen, Wageningen Environmental Research, Working document.

1. Wageningen Plant Research

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Contents

1.Introduction

What are food systems?

"Food is what links humankind, now and in the future" (Fresco 2009). Food systems (FS) are the interlinking network of people and places, actors whose activities coupled with biophysical resources provide us with our food, mediate our health, and deal with our food waste; culture and values of people shape FSs, political and economic forces can disrupt them (von Braun et al. 2021). They are fundamentally socio-ecological systems (Dahlberg 1993, Jacobi et al. 2018). In REFOOTURE[1], we treat food systems as socio-ecological systems (SES) that per definition include many dimensions[2]. The understanding of such socio-ecological systems is that they are complex and adaptive, where people are embedded in nature, being influenced by and influencing each other, not separated into individual components or pillars (e.g., people, profit, planet) (Folke et al. 2016, Reyers et al. 2018). The FS, in this light, encompasses much more than agriculture and food value chains, it includes all aspects of food and its conversion, as these are complex nested systems. In other words, they comprise of different sub-systems (e.g., agricultural production, transport, processing, waste and water management, sector governance) which are interlinked with other socio-ecological and socio-economic systems (e.g., energy, health, finances and economics of a region or country, including governance of mentioned sectors). In short, FS are webs of various interconnected social and ecological agents and processes (hence, socio-ecological systems). Concluding, FS are multidimensional living systems influencing and being influenced by various nodes and interconnections in their networks, e.g., political, technological, cultural, and natural.

What should be the (ideal) outcomes of a food system?

Starting from a place of potential (Mang et al. 2016, Mang and Haggard 2020), the (ideal) purpose of a food system is to ensure food and nutritional security for all people, while supporting decent livelihoods and well-being, as well as thriving ecosystems, through which, resilience to shocks and stresses (e.g., climate events, political events) can be manifested (Jacobi et al. 2018, Ifejika Speranza et al. 2014, Du Preez et al. 2020). Having resilient food systems, is not only about the capacity to buffer and absorb shocks and stresses across the five capitals (i.e., human, social, natural, financial, and manufactured)[3], it is also

[1] https://www.wur.nl/en/project/refooture-food-futures-eastern-africa.htm

[2] Definition of socio-ecological systems: "the social refers to the human dimension in its diverse facets, including the economic, political, technological, and cultural, and the ecological to the thin layer of planet Earth where there is life, the biosphere. The biosphere is the global ecological system integrating all living beings and their relationships, humans and human actions included, as well as their dynamic interplay with the atmosphere, water cycle, biogeochemical cycles, and the dynamics of the Earth system as a whole" (Folke et al. 2016).

[3] https://www.forumforthefuture.org/the-five-capitals: "The Five Capitals Model provides a basis for understanding sustainability in terms of the economic concept of wealth creation or 'capital'. Any organisation will use five types of capital to deliver its products or services. A sustainable organisation will maintain and where possible enhance these stocks of capital assets, rather than deplete or degrade them."

about our capacity and ability to have diverse connections to nature and to each other (self-organization), as well as to learn from each other (capacity to learn) (Ifejika Speranza et al. 2014, Jacobi et al. 2018). Through supporting the capacities that characterise resilient socio-ecological systems, the conditions required for food and nutritional security and sovereignty, decent livelihoods and thriving ecosystems can be achieved in a fair, just, and inclusive way (i.e., no one, including nature, is left behind) (Figure 1) (Tribaldos and Kortetmäki 2022, Tschersich and Kok 2022).

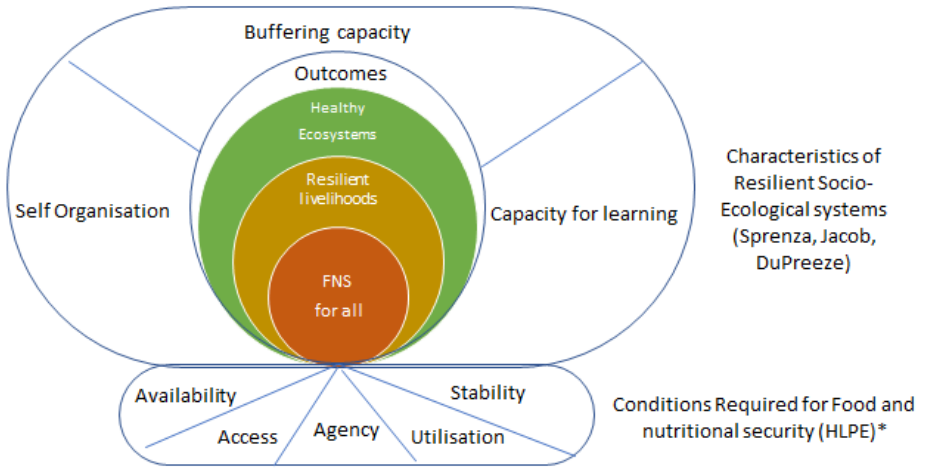


FIGURE 1 A graphical representation to show the nested nature of a food system which functions as part of a socio-ecological system characterized by three key elements of resilience; if present they can support the conditions required for food and nutritional security (adapted from Jacobi et al. 2018, Ifejika Speranza et al. 2014, Du Preez et al. 2020, HLPE 2020). FNS: food and nutrition security.

In Figure 1 three important dimensions are displayed that help socio-ecological systems to build resilience. These are: 1) buffering capacity, 2) self-organisation and 3) capacity for learning and adaptation (Ifejika Speranza et al 2014, Jacobi et al 2018). Buffering capacity here refers to the capacity of the food system to absorb disturbances (e.g., climate change, policy changes) and cushion changes in a way that can use "the emerging opportunities to achieve better livelihood outcomes such as reduced poverty" (Ifejika Speranzan et al. 2014). Self-organisation refers to how food system actors can have certain levels of autonomy, are free to act (agency), are free to instigate collective action, are independent and decentralised, are self-reliant and are capable of controlling certain food system processes and self-regulate themselves in order to ensure the food system is functioning properly. Thus, helping to foster trust and contributing to the empowerment of food system actors (Ifejika Speranza et al. 2014, Jacobi et al. 2018). "Self-organisation highlights how human agency, adaptive capacities, power and social interactions shape social resilience". Capacity for learning and adaptation is crucial for long-term food system resilience and livelihood resilience, as it enables people to also be able to anticipate and buffer against certain shocks. Capacity for learning refers to an adaptive style of management, where previous experiences are reflected upon

in context and incorporated into current actions and planning. The capacity to act can be at the individual level, at the multi-actor level (e.g., user groups) or at a higher system level (Ifejika Speranza et al. 2014, Jacobi et al. 2018, Steenhuijsen Piters et al. 2021). To date many of the discussions on food system resilience have been at higher system level, with limited attention been given to understanding better the role of the human capacity for learning and adaption‟which is at the heart of a resilient food system" (Steenhuijsen Piters et al. 2021).

How are current predominant food systems failing? Issues and challenges

Over the last century food systems have morphed from diverse locally and regionally based networks to one of a global homogeneous, hyperconnected behemoth, which is an economically efficient system, heavily reliant on fossil fuels and cheap chemical inputs (Dahlberg 1993, Dahlberg 1994, Sundkvist 2005, Loring 2022). Such heavily industrialised, petrochemical food systems are at the centre of many of the grand societal challenges facing us today: climate change (e.g., 26% of global greenhouse gas emissions are from food production), water conservation (e.g., 70% of freshwater withdrawals are for agriculture, while 46% of the world population does not have access to safely managed sanitation), biodiversity loss (e.g., although global trends are mixed, overall, there is a steep decline of biodiversity), poor health (e.g., outdoor air pollution is one of the world's largest health and environmental problems), malnutrition and hunger (e.g., 22% of children younger than five are stunted)[4], and land grabbing (many land deals take place in low- and middle-income countries, implying the potential conversion of smallholder farms to commercial use)[5]. They are not working for all (e.g., increasing numbers of people are going hungry and are highly sensitive to system shocks, e.g., climate events, pandemics, economic recession, and war), fundamentally they lack long term resilience (Ifejika Speranza et al. 2014, Jacobi et al. 2018, Du Preez et al. 2020, von Braun et al. 2021).

Therefore, there is a radical and unprecedented need to disrupt, reconfigure, redesign, and regenerate our food systems (Dahlberg 1993, Dahlberg 1994, Anderson and Rivera-Ferre 2021, Loring 2022), in particular, the most common form of extractive food system, the agro-industrial complex (Fresco 2009, Fresco et al. 2017). This is because *"extractive food systems view nature as something to be exploited by humans for profit and material gains, they do not view it as a living system with many intrinsic values upon which humans are dependent upon for our very existence"* (Anderson and Rivera-Ferre 2021). Extractive systems operate usually on a global scale characterised by long supply chains and a disconnection between consumer and producer, with power concentrated in the hands of a few dominant multinational corporations and comprise of complex industry driven subsystems (Fresco et al. 2017). In these systems farmers are dependent on external inputs and have lost much of their market and resource autonomy (Sundkvist et al. 2005, Fresco 2009, Anderson and Rivera-Ferre 2021,

[4] https://ourworldindata.org/#entries

[5] https://www.statista.com/chart/19044/countries-most-affected-by-land-grabs/

van der Ploeg 2021). These extractive systems are also characterised by weakened links to ecosystems and with indigenous knowledge being replaced by standardized knowledge, resulting in reducing the cognitive awareness, of all people in the food chain, to the signals or ecological feedback[6] coming from unhealthy ecosystems supporting food production (Sundkvist et al. 2005, Fresco 2009). This in turn reduces the capacity for learning and adaptation in order to build resilience into the food system. *"Food systems that build public health, community vitality and resilience are essential; industrial agriculture fails in all of these ways. Industrial agriculture increases productivity and yields in ideal circumstances, but at the cost of long-term sustainability"* (Anderson and Rivera-Ferre 2021).

How to rethink the food systems?

The profound changes that we need to rethink and regenerate in the food system require a change in our world views, shifting our mindset from mechanistic to ecological (Mang and Reed 2012). Anderson et al (2021) in their very comprehensive paper on food system narratives identified that *"different framings and narratives regarding the future of food co-exist..."* and that such... *"framing and narratives have profound implications for what people see and value,... in food systems, different narratives are associated with different mental models regarding food systems and use different framings that result in different approaches and different (if not opposing) results in the solutions"*. They proposed the use of two narratives to explore and frame the direction and outcomes of future food systems, these are the extractive food systems narrative and the regenerative food systems narrative. For extractive food systems as outlined above, the central narrative themes are *"appropriation and competition., productivism... modernisation., consistent with neoliberal economic concepts"*. In contrast, regenerative food system narratives focus on *"activities and imaginaries that can restore or enhance communities and ecosystems (human, social, financial, physical, natural capital) eroded by decades of implementation of extractive narratives"* (Anderson and Rivera-Ferre 2021). The latter does not exclude non-eroded systems taking part in the regenerative food system narrative. These systems may seek to further realize their potential, which will help them resist capture by the extractive narrative. This capture is often done by promising short-term benefits but not disclosing that this comes at the price of jeopardizing long-term viability.

Dahlberg (1993) was one of the first to imagine and document a regenerative food system concept, as a nested system *"of agriculture, food systems and societies operating within the larger framework of socio-natural[6] systems"* operating at different scales (e.g., farm, communities, landscapes) and different time horizons (e.g., short term to intergenerational) and within different contexts enabling a closer link with ecosystems to utilise and recognise potential ecological feedbacks in the systems. *"Regenerative approaches seek to understand how to reinstate and regenerate over the long term not only local cropping systems and farm families, but also rural communities, landscapes, and*

[6] Feedback loops can act as control devices in both natural and socio-economic systems. Negative loops counterbalance change and have a stabilizing effect, such as the regulation of our body temperature, while positive feedback reinforces change and amplifies rather than reverses change (Sundkvist et al. 2005).

regions" (Dahlberg 1993). In this way, also intrinsically building resilience into the food chains. Regenerative development is fundamentally place-based as "*it is only in relationship to place that humans experience a sense of intimacy with and responsibility for the living world*" (Mang et al. 2016). Characteristics of regenerative food systems are multifunctionality, diversity, engagement with one another while working with nature (e.g., using context specific, local, and indigenous knowledge) in recognition of our interdependencies, while trying to build the capacities to learn and thrive in the complexities of such socio-ecological systems (Dahlberg 1993, Dahlberg 1994, Duncan et al. 2020, Anderson and Rivera-Ferre 2021, Loring 2021).

In regenerative systems *"human beings are not separated from nature and caring for nature is a prerequisite in caring for humans"* (Anderson and Rivera-Ferre 2021). Yet, nature does not depend on humans, whereas humans depend on her. It also must be noted that food systems are nested systems, what this means is that local or regional food systems do not function in an independent vacuum, but they are part of a bigger system in a global system of different socio-ecological networks or economies interacting and engaging with one another. System nestedness and connections to the "greater whole" must also be taken into consideration when exploring options for regenerating a food system (Sundkvist et al. 2005, Mang et al. 2016)

"As a term, regenerative has several advantages over "sustainable." It points more directly to the need to regenerate both natural and social systems over time. It suggests the need for systems thinking at multiple levels and over multiple decades. It requires a shift from a narrow focus on production systems...it calls for the inclusion of issues of social justice, intergenerational equity, and inter-species balance. It is for these reasons that those working on regenerative approaches have chosen to use human evolutionary theories and a socio-natural framework to describe "the grand transitions" (Dahlberg 1993). *However, "understanding regeneration as a hierarchy of differentiated levels of work offers an ecosystem perspective that can reveal both the interrelatedness and necessary interdependence of the different sustainability approaches, as well as the distinctive niche each occupies"* (Mang et al. 2016).

In addition, the difference between regenerative food systems and sustainable food systems[7] is the approach to engaging and interacting with ecosystems. Sustainable food systems look to limit or reduce the impact of food production and distribution, thus acknowledging there will be an extractive type of approach implemented: humans as separate from nature. Regenerative on the other hand looks to work with nature to create a positive effect (e.g., using biomimicry, indigenous knowledge of the landscape systems), through caring for nature we can care for ourselves and for each other.

Another point which needs to be considered in rethinking our food system, is autonomy of resources and redistribution of power away from the few.

[7] A sustainable food system is: "A food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised. This means it covers the three pillars of sustainability. It is profitable throughout (economic sustainability); it has broad-based benefits for society (social sustainability); and it has a positive or neutral impact on the natural environment (environmental sustainability)" (FAO 2018a).

Therefore, there is the need to put inclusion "*squarely in focus when analysing long-term pathways for food systems transformation"* (Gaupp et al. 2021)[8]. Thus, as Andersen et al (2021) outlined there is a need to ask targeted questions when assessing transformations in the food systems: productivity gains are for whom—what living being or system? innovations are coming from whom and for what purpose? What are the consequences (intended and unintended, positive, and negative externalities) and capital costs[9] of such system changes – ultimately, who wins and who pays? This is where the approach suggested by Ifejika Speranza et al. (2014) and their application of such livelihood resilience or socio-ecological resilience of food systems has been used to try and monitor outcomes (Jacobi et al 2018). In other words, are our actions leading to the futures envisioned for a regenerative inclusive food system? (Figure 1).

Concluding, the entry point of regenerative development differs from sustainability: Sustainability relies on the assessment of the compartments people, planet and profit, while regenerative tries to see and use the complexity and interrelationships. The aim of sustainability to sustain states can have the fundamental premise that we just seek making less damage, still in the same type of food systems as before. Regenerative puts forward that we are part of nature and therefore need to approach our natural environment in a completely different way, namely as equals at the table.

[8] "We define inclusion as a focus on the weakest and most vulnerable, as it relates to access to and affordability of food, and employment and wages in the food system" (Gaupp et al. 2021).

[9] We refer here to the five capitals.

TABLE 1 Comparative descriptions from the literature for Degenerative - Sustainable – Regenerative Food Systems

Degenerative FS	Sustainable FS	Regenerative FS
Mindset: Reductionist tendencies, focusing on the appropriation and extraction of resources (e.g. people, nature) driven by "*strong economic incentives or subsidies, policies, or cultural norms...There is the assumption that the resources in question cannot be overharvested, or that they are so easily substituted that overharvest is irrelevant*"[1] **Characteristics:** People are also extracted from their communities as cheap labor, there is low livelihood resilience, and "*rigid livelihood strategies that focus only on one or a few of the options that are available*"[1]. People are very vulnerable to exploitation and shocks (e.g., political, climate events), there is gross inequalities and accumulation of wealth and power. People are replaced through cheaper substitutes or automation (for economic gain), no consideration for cultural impacts. People in poverty are living in a vicious circle to continue extractive practices, as there are no other options or opportunities. Natural habitats and ecosystems are decimated leading to the emergence of novel diseases (e.g., zoonotic diseases), toxic chemicals accumulate and magnify playing havoc for biodiversity and human health. Heavy impacts on the functioning of ecosystems to provide, for example, healthy air, climate regulation, water purification. Technologies are used for exploitation purposes and innovations are only understood as inventing a technology that is for profit, not necessarily related to societal need. Food is unevenly distributed, and this contributes to the manifestation of food insecurity (inability to meet adequate food consumption requirements) either at a specific time or all the time, which threatens lives and livelihoods, regardless of the causes, context or duration **Example:** "Fishing down the food web"[1,2]	**Mindset:** Humans are still separate from nature, in control, we can continue what we are doing, if we can cause less damage or limit the damage, FS "*has a positive or neutral impact on the natural environment*"[3] while pursuing activities that favor and maintain the abundance of only one or a few highly valued key resources". **Characteristics:** People have greater economic opportunities but cannot always invest in their local communities or places where they live, as they still must move where there are jobs. For many people, they have gained a level of livelihood resilience, however it is not the same for everyone, some people are still very vulnerable to potential FS "disruptions and boom-and-bust dynamics"[1] of globalized markets or climate events. Natural habitats that have been fragmented, are conserved, and protected. Production systems are circular reducing raw material inputs and closing loops and are no longer dependent on fossil-based sources. The toxicity and accumulation of harmful chemicals in the soils and food system have been remediated and reduced and are within acceptable limits. Smart water systems have been installed that can enhance water use efficiency, particularly to buffer climate impacts. There is a large dependency on technologies and data to provide answers, with some displacement of people in certain economic sectors, but most people can be upskilled again. High yields with low impacts can ensure food and nutritional security for the majority. **Example:** "Maine lobster fisheries"[1]	**Mindset:** Being open to the complexity of nature and humans are part of nature, and we need to care for nature. All the answers may not be known, but we will learn. " Regenerative systems are high in both flexibility and diversity and entail cultural systems that conserve change by emphasizing responsiveness to environmental cycles and feedbacks while also valuing ecosystem and food system diversity as outcome"[1] **Characteristics:** People have greater opportunities to invest in communities and in the places where they live. They are driven to look after nature and one another. "Regenerative systems are high in negentropy because livelihood strategies work actively to complement or enhance natural cycles of release and renewal"[1]. Building in livelihood resilience to deal with changing conditions (e.g., political, climate events) Natural Habitats and ecosystems are diverse and healthy and have been given the opportunities (space and care) to coevolve with humans. The natural systems are in balance to evolve to deal with and protect against bioaccumulation of potential natural toxins or diseases. Technologies are used within a nested knowledge framework of how ecosystems can function fully, they help people coexist and enhance the natural world. Technologies are developed in a circular way and potentially open-sourced manner, supporting societal needs. They are partnering with life and upskill people, not causing job losses or inequalities. Food and nutritional security is secured but from a more local and diverse base, diet and relationship to food is in balance with what ecosystems can provide. The food system is nested entirely within a health system conscious of natural feedback loops between humans and nature. There are no disparities and no one is left behind. **Example:** unknown so far

1. Loring 2021, for the Maine lobster example, please see the discussion in Loring. 2. Pauly et al. 1998. 3. FAO 2018a. Many of the descriptions are based on literature the most part has been derived from the papers of Anderson and Rivera-Ferre 2021, Loring 2021, Mang et al. 2016, Dahlberg 1989, Dahlberg 1993, Dahlberg 1994.

2. Deriving principles for Regenerative Inclusive Food Systems – RIFS

There is a tendency today to adhere to a uniform or global vision of agriculture and food systems. Regenerative food system approaches challenge this. The regenerative narrative argues that for increasing long term food system resilience and adaptability, there is a need to have a greater diversity of visions which are rooted in local social and ecological systems, being co-developed by the actors involved in these food systems "Visions help chart the course of the future. They embody the hopes of a better future and often the fears or basic questioning of present practices and trends" (Dahlberg, 1993). Diversity refers to stakeholder groups with various visibility and power, as well as heterogeneity within such groups.

Visions and narratives are interrelated and as (Anderson and Rivera-Ferre 2021) outlined "if narratives, their associated strategies and their likely outcomes are not made explicit, then there is the risk of creating confusion, particularly at the policy and research levels". From the introduction we determined that a food system which functions as part of a socio-ecological system should have the following outcomes: food and nutritional security/sovereignty for all, resilient livelihoods within a healthy ecosystem, where all have equal opportunity. Therefore,

We define regenerative inclusive food systems as socio-ecological systems that are working innovatively with nature to ensure vibrant and healthy ecosystems which enable resilient livelihoods and food and nutritional security for all. In this fair and just transition, no being is left behind. These outcomes support the place-based vision-building in combination with principles to provide direction. Stakeholders are actively and responsibly steering their food systems.

Principles can be used to first support the vision generation of what regenerative inclusive food systems could look like for a certain place and community. They can serve as a *"rudder to navigate the uncertainties, turbulence, and emergent challenges of complex dynamic" systems, particularly "overarching principles can provide the big-picture and general guidance"* (Patton 2018). Principles also can be used to provide direction to support achieving the regenerative goals of a particular place-based project (Mang and Reed 2020).

We established the principles for regenerative inclusive food systems as part of the REFOOTURE project (https://www.wur.nl/en/project/refooture-food-futures-eastern-africa.htm). They were developed through integrating a combination of literature research and the result of interdisciplinary discussions which were held as part of cross collaboration and knowledge building exercises.

In investigating the literature to determine what are the general principles being used as a "rudder" for regenerative development approaches we found those outlined in Table 2. A further set of principles and alike concepts are outlined in Table 3, although not necessarily explicitly framed as regenerative development.

There are several common threads among these regenerative principles. The principles:

- Encourage to start with potential
- Reconnecting humans with nature and with place – nourishing life
- Promote diversity of people, knowledge, place
- Promote accountable innovations that are value-adding[10]
- Encourage mutualistic relationships strengthened through a common purpose
- Promotes autonomy and responsibility of decisions and resources by communities and local people
- Promotes a shift to holistic thinking, systems thinking
- Promotes adaptive and collective learning – regenerative capacities
- Promotes designing for long term (intergenerational)

This list was used as the basis for harvesting the different interdisciplinary discussions held by the REFOOTURE team[11] (e.g., from statements, key phrases, discussion points on agendas and questions raised). It was also used to mine various documents written by members of the REFOOTURE team (e.g., phrases, key words or synonyms). This was done to determine the key principles that could provide direction towards a transition towards regenerative inclusive food systems. Five principles were identified to support regenerative inclusive food systems (RIFS). Compare Annex I for a summary of the five guiding principles we have derived for RIFS. We will provide an overview of the principles as well as their scientific grounding in the succeeding sections.

[10] Value-adding can here be defined as changes to the food system that improve the state and capacities of such systems in a way to reach the interconnected system goals.

[11] Discussions such as for example, cross country dialogues , BIMOMICOS (bimonthly meetings) and individual conversations with partners.

TABLE 2 The guiding principles of regenerative approaches from various institutes and academics involved in and practising regenerative development

	Regenerative development & design[1]	Regenerative economics[2]	Regenerative food systems[3]	Regenerative capitalism[4]	Regenerative communities[5]	Regenerative development[6]
1	Design for evolution	Maintain robust, cross-scale circulation of critical flows including energy, information, resources, and money	Acknowledging and including diverse forms of knowing and being,	In right relationship	Working with whole systems	Works in whole systems (not fragments)[a]
2	Partner with place	Regeneratieve re-investment	Taking care of people, animals, and the planet	Views wealth holistically	Being in reciprocal relationships	Shifts thinking towards holistic worldview [a]
3	Call forth a collective vocation	Maintain reliable inputs & healthy outputs	Moving beyond capitalist approaches	Innovative, adaptive, responsive	Focusing on potential	Manifests potential in a place (potential- focused, not problem-focused)[b]
4	Actualise stakeholder systems towards co-evolving mutualism	Maintain a healthy balance and integration of small, medium, and large organizations	Communing the food system	Empowered participation	Working from uniqueness	Grows regenerative capacity (in human and more-than-human components of living systems—viability, vitality, evolutionary capacity)[b]
5	Work from potential, not problems	Maintain a healthy balance of resilience and efficiency	Promoting accountable innovations	Honours community and place	Nourishing life	Value-adding: Contributes to healthier functioning/vitality of two next higher scales[c]
6	Find your distinctive value adding role	Promote mutually-beneficial relationships and common-cause values	Long-term planning and rural-urban relations	Edge effect abundance		Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier, more vital wholes[c]
7	Leverage systemic regeneration by making nodal interventions	Promote constructive activity and limit overly extractive and speculative processes		Robust circulatory flow		Nodal leverage points: Identifies and shifts systemic leverage points to increase health and wellbeing[c]
8	Design the design process to be developmental	Promote effective, adaptive, collective learning		Seeks balance		

Sources: 1. Regenesis Institute (Mang et al. 2016), 2. Fath et al. 2019 as based on Fullerton 2015, 3. Duncan et al. 2020, 4. Capital Institute (Fullerton 2015), 5. CLEAR - Center for Living Environments and Regeneration (Plaut et al 2012), 6. Gibbons 2020 – three meta-principles are defined by letters with: a) referring to wholeness, b) referring to change and c) referring to relationships.

TABLE 3 Principles or values of related comprehensive concepts and movements

	Building resilience: sustaining ecosystem services in SES[1]	**Green Belt Movement: three standards and four spiritual values[2]**	**Organic farming[3]** (including upstream and downstream sectors)	**Agroecology elements[4]**	**Agroecology principles[5]**	**Seven tendencies towards regeneration in agriculture, communities and personal spirit[6]**
1	Maintain diversity and redundancy	Honesty	Health	Diversity	Recycling	Pluralism (diversity)
2	Manage connectivity	Hard work	Ecology	Co-creation and sharing of knowledge	Input reduction (reduce or eliminate the dependency on external inputs)	Protection
3	Manage slow variables and feedback	Commitment to transparency and accountability	Fairness	Synergies	Soil health	Purity
4	Foster complex adaptive systems thinking	Love for the environment	Care	Efficiency	Animal health	Permanence
5	Encourage learning	Gratitude and respect for the earth's resources		Recycling	Synergy	Peace
6	Broaden participation	Self-empowerment and self-betterment		Resilience	Diversity	Potential
7	Promote polycentric governance systems	Spirit of service and voluntarism		Human and social values	Diversification	Progress
8				Culture and food traditions	Co-creation of knowledge	
9				Responsible governance	Social values and diets	
10				Circular and solidarity economy	Fairness	
11					Connectivity	
12					Land and natural resource governance	
13					Participation	

Sources: 1. Biggs et al 2022, 2. Maathai 2010, 3. IFOAM 2020 , 4. FAO 2018b, 5. HLPE 2019, 6. Rodale and Rodale, no year

Principle 1: Sense of place and purpose

Regenerative inclusive food systems start with people, and with our unique experience of the place where we live. Through caring for each other and for nature in the places where we live, we can nourish ourselves and feel part of a community and of a place.

Regenerative inclusive food systems are initiated "with people, and with their unique experience of the place where they live...built from the unique needs and strengths of people where they live" (Mang et al. 2016). The idea of place is crucial for people to develop a concrete understanding of their role in mutualistic relationships with nature. *"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong we may begin to use it with love and respect"* (Leopold and Schwartz 1968).

Regenerative inclusive food systems return the places where we live back to the core position of human life, where they can become a source of shared meaning and caring that can enable people to have a common cause with one another and with nature (Fullerton 2015, Fath et al. 2019, Gibbons 2020, Mang et al. 2016). *"Within human communities a collective purpose or vocation enables people to work intentionally, independently and in diverse ways towards a common aim...it can inspire will and action and a guiding path suited to the unique character of a place increasing the vitality and viability..."* (Mang et al. 2016) of the socio-ecological systems within which communities find themselves and thus, in turn, the food systems of which they are part.

When we are closer to those who produce our food and understand how it is produced, this promotes a greater awareness of ecological feedbacks and how to adjust and adapt the local socio-ecological systems to ensure food system resilience [4] (Dahlberg 1993, Dahlberg 1994, Sundkvist et al. 2005) *"humans can translate ecosystem understanding into concrete, place-specific strategies for cooperation"* (Mang et al. 2016). *"Regeneration in its place-based articulation facilitates contextualizing and identifying the distinctive character of society and place. The regeneration hypothesis helps to effectuate a worldview through which human and natural systems can form mutually beneficial symbiotic relationships. It requires communities to go beyond sustaining and make concerted efforts to positively contribute to and enrich the environments which they inhabit. Thus, a regenerative view transforms the relationship of people with place, from exploiters to partners who co-evolve"(*Mehmood et al. 2020).

The local anchorage point can be specific pedoclimatic conditions; the use of locally available natural resources, including plant varieties or animal breeds; local diet preferences, knowledge, or traditions; specific institutions; just to name a few. The idea is to benefit from, sustain and further the existing potential and resources. Observing, understanding, knowing, and caring are essential competencies.

Principle 2: Socio-ecological design for innovation

The innovations are triggered by the needs of a community, where innovators are inspired to find solutions and opportunities in using the available resources and indigenous knowledge in more effective and creative ways, while working with nature for the collective well-being of all.

One of the core premises of ecological design is the need to transition our social systems to a greater reliance on renewable resources through recycling, reusing and dematerialisation. We need to be able to mimic the fundamental designs, networks and structures of nature, while at the same time enhance those diverse natural systems by becoming more aware of ecological feedback (Shu-Yang et al. 2004, Sundkvist et al. 2005, Mang et al. 2016). In relation to ecological economic theory "*it is not possible for human ingenuity to create human-made capital without support from natural capital*" (Berkes and Folke 1992). Furthermore, Loring (2022), identified that "*Strategies to achieving regenerative food systems must also be restorative and retributive in nature—not merely a swapping out of new practices for old—but designed to address and compensate for past social and ecological harms while also devoting sufficient resources to restore local biodiversity and social capital*".

Again, when it comes to the use of socio-technical innovations (e.g., machinery or digital technologies) within the food systems, we also need to ask important questions around the issues relating to the autonomy of the resource base, data security, rights and access (Gkisakis and Konstantinos 2020, van der Ploeg 2021). It is important to know, what are the technologies being promoted? By whom? Who has ownership and rights? Who benefits and what is the relationship between such technologies and indigenous innovations and knowledge? (Nyéléni 2019). Finding tailored solutions to manage the diversity of needs across the food system, particularly for farmers should also be reflected in the types of tools that are developed for farmers, which in many cases should be co-designed and developed with farmers themselves. This in turn could mean that the current paradigm or agricultural innovations being a "one-type-fits all" or "top-down" solutions designed by the agroindustry will become redundant. Thus, potentially giving farmers the rights to their own designs and their own data (Gkisakis and Konstantinos 2020, Salembier et al. 2020).

Indeed, it is largely recognised that transitions through system innovations *"require new organisational capabilities and changes to business models, infrastructure, institutions, and cultural perspectives. Due to this complexity, system innovations cannot be designed and implemented from the top down because no single decision maker has sufficient knowledge, financial means, and a social license to undertake it"* (Kemp et al. 2020). Therefore, we look to the

concept of social innovations[12] which seek not only to introduce new types of products or services not yet provided by the market, but also seeks to introduce more novel ways of using existing products and knowledge (i.e., reconfigure or regenerating aspects that do not bring added value to the majority). Such social innovation encourages and motivates the role of human agency, to catalyse a change in existing attitudes[13], reconfiguring social networks and governance to improve the collective well-being of the community (Baselice et al. 2021). Through regenerative action "new socially innovative agency is created" (Mehmood et al. 2020). One concrete example of regenerative action in the food system is the holistic approach promoted by agroecological practices (Dahlberg 1993, Dahlberg 1994). Redesigning food systems based on the principles of circular economy can help address the global food waste challenge, in the process making food value chains shorter and more resource-efficient (Gliessman 2006, FAO 2018).

Therefore, merging social innovations with the conceptual thinking and framing of ecological design can create new, more satisfactory ways of giving people and nature a place within RIFS. Such innovative ways of production start when people focus on the potential around them (principle one), helping them to identify "*powerful opportunities that are lost when we work from a typical problem-solution orientation*" (Mang et al. 2016) . Thus, leading to appropriate products and services required by the local communities nested within a certain food system.

Principle 3: Building connections

Building connections with each other and with nature makes us stronger, together we are stronger and better able to cope and adapt with system changes.

Regenerative inclusive food systems are living systems nested within larger living systems (e.g., watershed, biomes, families, communities). The longevity, vitality and fitness of regenerative food systems are tied directly to their beneficial integration into a larger system (Mang et al. 2016). The nature and strength of these connections between people and between people and nature are critical to the transition

[12] Within the SIMRA project, social innovation is defined as "The reconfiguring of social practices, in response to societal challenges, which seeks to enhance outcomes on societal well-being and necessarily includes the engagement of civil society actors". This definition emphasizes the key role of human agency in transforming existing attitudes, social networks, or governance arrangements to ameliorate the collective well-being of the community (Baselice et al. 2021).

[13] Attitudes are a predisposition or a tendency to respond positively or negatively towards a certain idea, object, person, or situation. They are linked with culture, social norms, opinions, beliefs, ethical and moral values (individual or shared), and discourses. People's attitudes are affected by the socio-economic context and historical development trajectories in which they live, as well as by states of feeling, emotions and are contingent to personal circumstances. Attitudes influence the collective and individual choices of action, and responses to challenges, incentives, and rewards (Secco et al. 2020).

towards regenerative and inclusive food system (Dahlberg 1993, Dahlberg 1994). Connectivity is established in diverse ways. In terms of physical relationships (e.g., to places, along rivers, between roads and railways), digital relationships (e.g., internet, information technologies) or social and socio-ecological relationships (Steenhuijsen Piters et al. 2021, Secco et al. 2020).

"Social capital describes the way in which people form connections through relationships and networks built on trust and reciprocity in order to enhance cooperation, collective action and resilience" (Niles et al. 2021). There are two distinct types of social capital. "Structural social capital facilitates information sharing, and collective action and decision making through established roles, social networks and other social structures supplemented by rules, procedures, and precedents. Cognitive social capital refers to shared norms, values, trust, attitudes, and beliefs" (Grootaert and Van Bastelar 2002). Structural and cognitive social capital are established through three recognized activities: bonding (e.g., relationships within social groups), bridging (building relationships among different social groups) and linking (e.g., networking between individuals and groups with differing social positions) (Kizos et al. 2014).

Whereas cultural capital can be described as "the aptitude or inclination of a group or society to behave in a certain way, underlies human and social capital and describes the potential of a group or society" (Cochrane 2006), which has been shaped by the geographical space they co-inhabit with nature (Berkes and Folke 1992). Cultural capital can then be used to understand the guiding rules and interactions over time between communities and their natural, historical and social environments. It also helps to understand the means with which societies can deal with the natural environment and how they have derived their identities from their local surroundings (Cochrane 2006, Kassam 2009). Therefore, the "social, ethical and spiritual relationships have an ecological foundation; and the practical manifestation of cultural values, in turn, has consequences for the ecosystem" (Kassam, 2009).

Social and cultural capital are important for regenerative inclusive food systems not only because these determine how natural capital will be converted into other forms of capital, e.g., economic, or physical (man-made) capital (Berkes and Folke 1992, Kizos et al. 2014), but also how these forms of capital will be shared and used. Social capital is associated with decreased risk of hunger (Martin et al. 2004), among other benefits and it is increasingly being recognized that a lack of social capital can have consequences for health, poverty, and inequality (Chetty et al. 2022). Therefore, in RIFS the benefits of social and cultural capital should be utilized to ensure synergistic relationships with nature, resilient livelihoods and food and nutritional security for all.

Principle 4: Fair, just and inclusive transitions

In a regenerative inclusive food system, justice, fairness and inclusivity are the foundations for promoting responsibility, accountability and giving a voice to all those involved in the production and consumption of food, including nature.

In its current form "persistent injustices, inequities, and dynamics of exclusion are embedded throughout agri-food systems" (Hebinck et al. 2021) and "most food systems across the globe do not deliver all the outcomes that society expects…one of the principal causes of a food system's failure to evolve in desired directions is its governance[14]" (Berkum et al. 2018). The term "*transitions is increasingly used to refer to large-scale societal changes, deemed necessary to solve "grand societal challenge"* (Loorbach et al. 2017), whereas the "*concept of 'just transition' originates from the labor and environmental justice movements' call to consider the economic and employment effects of environmental regulation. The concept was later taken up by climate activists and debates on environmental and ecological justice"* (Tschersich and Kok 2022). However, application to food systems is still just beginning. Recognized for any system transition is *"momentum, commitment and a large support base. Commitments to actions that are understood and underwritten by many stakeholders have a higher chance of being implemented than those agreed upon by few stakeholders"* (Berkum et al. 2018). Furthermore, due to the complex, global interlinkages of agri-food systems and their potential effects on future generations, transitions need to ensure just distribution through consideration of the various perspectives and prospects of such 'distant voices', unable to directly participate in governance processes of agri-food transitions (Tribaldos and Kortetmäki 2021, Tschersich and Kok 2022).

Food systems are socio-ecological systems and are dynamic, therefore, the governance of these systems also needs to be dynamic, as "governance systems based on policies that try to control few ecological processes (command and control) do not allow the sustaining of the capacity to deal with change, producing fragile SESs. A central aspect in dealing with SESs is that they are characterized by cross-scale interactions, both temporal and spatial, and the same is applicable to their governance, because decisions taken at one place in the past and in the present can affect people currently or in the future living elsewhere" (Petrosillo 2015). Therefore, enabling just agri-food transitions will then require *adaptive, reflexive and pluriform governance efforts that confront fundamental inequalities* (Tschersich and Kok 2022). It needs to combine both local and globally coordinated policy interventions aimed at democratizing agri-

[14] "Governance is inherently political: as a result of conflicting interests and power imbalances, food systems fail to deliver equitable and just access to food. Moreover, the impacts of shocks and stressors are not evenly distributed across actors in the food system. There are significant differences in vulnerability and response capacities between different groups of people, sectors and regions" (Berkum et al. 2018).

food markets and their governance, in particular dismantling global market and power concentration, which have been identified as major causes of lock-in to the current industrial agricultural system (Tschersich and Kok 2022, Berkum et al. 2018). It is fundamental that any transition in the food system redesign must be grounded with social and ecological consideration at the heart of these systems, that work together in ways that are regenerative and provide food and nutritional security for generations to come (Berkum et al. 2018). "Transition processes need to be reflective of potentially reinforcing structural injustices and aim to challenge and 'unmake' these incumbencies" that do not work for everyone or nature (Tschersich and Kok 2022). Therefore, "reshaping food systems to be inclusive of poor and vulnerable people is a moral imperative" (IFPRI 2020).

"Inclusive food systems reach, benefit, and empower all people, especially socially and economically disadvantaged individuals and groups in society. Inclusive food systems reach vulnerable people by way of reducing barriers that currently prevent them from participating in food system activities, for example, by enabling them to gain the skills needed to work within evolving food value chains" (IFPRI 2020). "Just transitions in food systems require the development and nurturing of actors' adaptive capacities to respond to related demands in food production and consumption" (Tribaldos and Kortetmäki 2022). Building capacity is fundamental since "just transitions will entail rethinking processes of knowledge generation and giving voice to currently marginalized perspectives and voices" (Tschersich and Kok 2022), this also includes nature.

Principle 5: Design for renewal (it's a living process)

Transitioning towards regenerative inclusive food systems is a living process, it is a process of learning by doing, building the capabilities to regenerate the parts of the food systems to make them work for us and for nature.

The backbone of a regenerative inclusive food system that delivers the desired outcomes of: healthy ecosystems, resilient livelihoods, and food for all, are resilient socio-ecological systems (Ifejika Speranza et al. 2014, Anderson and Rivera-Ferre 2021).

However, it is important when discussing about resilience to understand that it is not an end state, and that resilience may not always be intrinsically positive[15]. Therefore, resilience needs to be understood in relation to specific contexts, social values, and norms. We must ask important questions such as, *"Resilience*

[15] "People may be perpetually locked into resilient but undesirable states of poverty and marginality" (Tanner et al. 2015) or the socio-technical regimes of industrial food systems can have internally stabilizing features that keep these regimes functioning (e.g. subsidies, concentration of power), so these systems are per se resilient but are not always entirely beneficial (Loring 2022).

of what type, and for whom?" (Ifejika Speranza et al. 2014, Jacobi et al. 2018, Tanner et al. 2015).

For socio-ecological systems, social resilience is a dynamic concept as it not only refers to peoples' capacity to buffer system changes and shocks (e.g., political upheavals, climate change), but also refers to their capacity for learning and self-organisation (Anderson and Rivera-Ferre 2021, Ifejika Speranza et al. 2014, Jacobi et al. 2018). Ifejika Speranza et al. (2014) defines social resilience as "the capacity of actors to access [livelihood][16] capitals in order to – not only cope with and adjust to adverse conditions (i.e., reactive capacity) – but also search for and create options (i.e., proactive capacity), and thus develop increased competence (i.e., positive outcomes) ". Ifejika Speranza et al. (2014) contextualised social resilience as livelihood resilience, as they determine that *"resilience can be used to characterise a livelihood system's ability to deal with change and recover".*

Loring (2022) identified that "Regenerative systems conserve change via flexible and diverse livelihood strategies". Indeed, to make food systems truly more resilient we need to practice adhering to "conserving change", what this means is that when "we manage our food systems for stability and uniformity, the more we risk diminishing the capacity of these systems…conserving that change means ensuring that our interactions with living systems work with rather than against the system of intersecting cycles that make regeneration possible" (Loring 2022). Regenerative inclusive food systems are living systems; they are dynamic and in a continuous state of change, which "requires us to treat change as a source of creativity" (Loring 2021, Mang et al. 2016).

However, to engage with the dynamic nature of food systems will require a change of mindset and a different way of thinking and approaching how we explore and understand our food systems (Anderson and Rivera-Ferre 2021, Loring 2021, Mang et al. 2016). Particularly if we want a fair and just food system transition, *"this will entail rethinking processes of knowledge generation and giving voice to currently marginalized perspectives and voices"* (Tschersich and Kok 2022). It is clear therefore that we need to undergo a type of transformative learning[17] (Mehmood et al. 2020). "*In regenerative systems people rely on tight feedback, and they need the power to observe, experiment, and adjust their actions in response to indicators of environmental change. Indigenous food systems, for example, which often involve complex seasonal calendars of practices and a large portfolio of alternatives, rely heavily on ecological knowledge and sustained environmental observation"* (Loring 2022). Enhancing people's capacities for learning through co-learning and sharing, a collective understanding of their food system can be developed and updated. Effective

[16] Livelihood assets are identified as the 5 capitals (natural, social, human, financial and physical capital).

[17] "Transformative learning as an approach to experiential pedagogy with focus on education and learning based in local communities and the surrounding places; second, experiencing place through sense-making to help people relate closely to their values and meanings of place; third, regenerative action to reverse and recuperate from the negative impact of humans on the environment and promote place stewardship. Through a dynamic combination of these processes, new socially innovative agency is created" (Mehmood et al 2020).

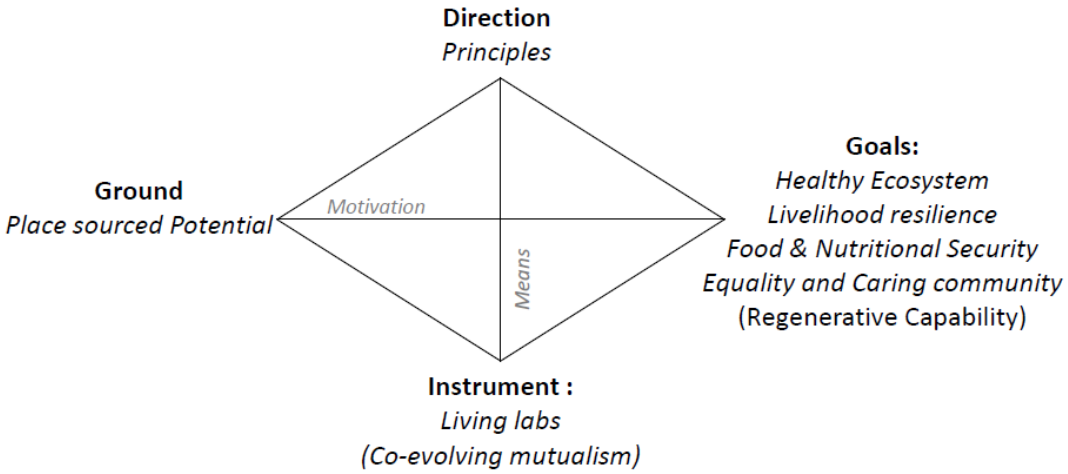
collective learning has been central to humanity's survival and is crucial to the long-term vitality of regenerative inclusive food systems.

One's worldview is the filter through which we perceive and understand phenomena; developing awareness of it is the first step toward change (Mang and Reed 2012). "*Transitions to new worldviews 'take hold' as the new paradigms to which they give rise become embedded across disciplines..., increasingly being manifested as accepted standards, protocols, and processes*" (Mang and Reed 2012). This embedding process is accomplished at the level of practice through the advance and use of more comprehensive methods that are consciously rooted in the new worldview (Mang and Reed 2012).

3. The role of the RIFS principles in regenerative development

In promoting regenerative inclusive food systems, the overarching aim is to build the regenerative capability of the living systems of which we as people are part. The regenerative capability gives people agency for steering and to continue the living process in a meaningful way. How these RIFS evolve depends on the specific place and the people living there. Crucial is people's motivation to reach these goals, have and create opportunities and capabilities to innovate. The means or instruments that can be used to build regenerative capabilities, create opportunities, and foster motivation are, in the case of the REFOOTURE project, Living Labs and multi-stakeholder processes. These can create the space that enables collective co-creation processes and innovations sourced from place. The RIFS principles are to provide direction towards the goals of RIFS. They serve as a "rudder to navigate the uncertainties, turbulence, and emergent challenges of complex dynamic" systems, particularly "overarching principles can provide the big-picture and general guidance" (Patton 2018).

FIGURE 2 Regenerative Tetrad© for the REFOOTURE project, adapted from Regenesis Group with



permission.

Within the REFOOTURE project, we use an adapted Tetrad[18] from the Regenesis group (Figure 2) to help us bring together the four sources of an activity[19] that have been identified as relevant for transforming systems, in our case food systems. These four elements must be brought into alignment to enable the transformation we seek to achieve.

The RIFS principles give us guidance for defining RIFS futures, identifying stakeholders, assessing what is needed in the situational analyses, understanding potential and context, differentiating between approaches to sustain states from those that take people and nature as equals, defining what is more on the degenerative and what is more on the regenerative side, and finally tracking what we do in a way to enhance further regenerative development. The principles help us, including the food system stakeholders, in designing systems and particularly the processes towards those.

Regenerative change is a process which starts within us and our mindset. All members of society, but particularly scientists need to reflect on their role, position or influence they may have, because "*if researchers are to meaningfully engage with just transitions in agri-food systems, it thus requires turning the gaze to how (global) scientific systems themselves are organized and linked to agri-food systems, for instance by valuing both scientific and traditional agroecological knowledge on equal footing in publications and policy recommendations (including through co-authorships with practitioners), and reforming (scientific) institutions to support such processes*" (Tschersich and Kok 2022).

Agency of people is central to a regenerative approach. Regenerative development goes well beyond dissemination of best practices. It rather focuses on the empowerment of people and nature and this is crucial to pave the way for continuous renewal and responsible citizenship: "*With hunger on the rise, we must consider whether the existing four-pillar framework for food security needs further updating to take the complexities of the current situation more fully into account in policies that aim to address food insecurity...Specifically, widening inequalities and persistent hunger among those who are least advantaged in society have prompted some scholars to approach food security from a 'human development' perspective that highlights the importance of ensuring that people have agency to shape their own relationships with food systems and to address power imbalances within those systems*" (Clapp et al. 2022).

While change can be very local, such as simple adjustments of collaboration or management practices, these are finally connected to a larger context: Food systems are nested systems, what this means is that local or regional food systems do not function in an independent vacuum, but they are part of a bigger system, a global system of different socio-ecological networks or economies

[18] "Dynamic systems frameworks are ways to make one's thinking explicit, to manage it, and to improve the effectiveness of collaborative work. Together with developmental processes, they are instruments for understanding the complex, dynamic wholes within which we live, so that we can be conscious participants. Frameworks shape what we pay attention to and how we act. They enable our minds to give form to information", the Tetrad is such a tool that can help us to ask ourselves, how should I be thinking about this work – from TRP training programme Regenesis.

[19] Activity can refer to a multistakeholder process, to a project to a programme of research.

interacting and engaging with one another. System nestedness and connections to the "greater whole" must also be taken into consideration when exploring options for regenerating a food system (Mang et al. 2016, Sundkvist et al. 2005).

In the start-up phase of REFOOTURE, we learnt that regenerative development is not "sustainability plus", it is much deeper. It is a change in mindset and an altering of our perspective on our relationship with nature and the role we need to play in restoring its regenerative capacity. "*Regenerative development involves humans in the story of restoration, it asks us to be in the dynamics of life*" (Bill Reed—Regenesis Institute). Eventually, applying regenerative development is more than just answering a separate set of questions. It starts by looking at places differently. We combined the RIFS principles and regenerative thinking and acting within workshops that we designed in the project to establish and run multi-stakeholder processes – compare the REFOOTURE document "Collaborate to Regenerate" (Reemer et al. 2022). In this process we also used the list of potential triggering questions linked to the RIFS principles (compare annex II), to be conscious of their inclusion in the process and to identify the principles when they appeared.

4.References

Anderson, M. D. and M. Rivera-Ferre (2021). "Food system narratives to end hunger: extractive versus regenerative." Current Opinion in Environmental Sustainability 49: 18-25.

Baselice, A., M. Lombardi, M. Prosperi, A. Stasi, and A. Lopolito (2021). "Key drivers of the engagement of farmers in social innovation for marginalised rural areas." Sustainability 2021, 13, 8454.

Berkes, F. and C. Folke (1992). "A systems perspective on the interrelations between natural, human-made and cultural capital." Ecological Economics 5(1): 1-8.

Berkum, S. v., J. Dengerink and R. Ruben (2018). The food systems approach: sustainable solutions for a sufficient supply of healthy food. The Hague, Wageningen Economic Research.

Biggs, R., Schlüter, M. and M.L. Schoon (eds) (2015). Principles for building resilience: sustainaing ecosystem services in social-ecological systems. Cambridge University Press, Cambridge.

Chetty, R., M. O. Jackson, T. Kuchler, J. Stroebel, N. Hendren, R. B. Fluegge, S. Gong, F. Gonzalez, A. Grondin, M. Jacob, D. Johnston, M. Koenen, E. Laguna-Muggenburg, F. Mudekereza, T. Rutter, N. Thor, W. Townsend, R. Zhang, M. Bailey, P. Barberá, M. Bhole and N. Wernerfelt (2022). "Social capital I: measurement and associations with economic mobility." Nature 608(7921): 108-121.

Clapp, J., W. G. Moseley, B. Burlingame and P. Termine (2022). "Viewpoint: The case for a six-dimensional food security framework." Food Policy 106: 102164.

Cochrane, P. (2006). "Exploring cultural capital and its importance in sustainable development." Ecological Economics 57(2): 318-330.

Dahlberg, K. (1989). "The value content of agricultural technologies and their effect on rural regions and farmers". Journal of Agricultural Ethics 2: 87-96.

Dahlberg, K. (1993). "Regenerative food systems." Management of Agricultural, Forestry, and Fisheries Enterprises 2: 175-189.

Dahlberg, K. A. (1994). "A transition from agriculture to regenerative food systems." Futures 26(2): 170-179.

Duncan, J., M. Carolan and J. S. C. Wiskerke (eds) (2020). Routledge Handbook of Sustainable and Regenerative Food Systems. Routledge, Abingdon and New York.
Du Preez, C. C., C. W. van Huyssteen, E. Kotzé and J. J. van Tol (2020). Chapter 2 - Ecosystem services in sustainable food systems: Operational definition, concepts, and applications. The Role of Ecosystem Services in Sustainable Food Systems. L. Rusinamhodzi, Academic Press: 17-42.
Fath, B. D., D. A. Fiscus, S. J. Goerner, A. Berea and R. E. Ulanowicz (2019). "Measuring regenerative economics: 10 principles and measures undergirding systemic economic health." Global Transitions 1: 15-27.
FAO (2018a). Brief: Sustainable food systems concept and framework. Available a: www.fao.org/3/ca2079en/CA2079EN.pdf.
FAO (2018b). The 10 elements of agroecology: guiding the transition to sustainable food and agricultural systems. http://www.fao.org/3/i9037en/i9037en.pdf
Folke, C., R. Biggs, A. V. Norström, B. Reyers and J. Rockström (2016). "Social-ecological resilience and biosphere-based sustainability science." Ecology and Society 21(3).
Fresco, L. O. (2009). "Challenges for food system adaptation today and tomorrow." Environmental Science & Policy 12(4): 378-385.
Fresco, L. O., R. Ruben and M. Heren (2017). "Challenges and perspectives for supporting sustainable and inclusive food systems." GREAT Insights September/October: 13-17.
Fullerton, J. (2015). Regenerative capitalism. How universal principles and patterns will shape our new economy. Capital Institute, Stonington.
Gliessman, S. R. (2006). Agroecology – The ecology of sustainable food systems. CRC Press, Boca Raton.
Gaupp, F., C. Ruggeri Laderchi, H. Lotze-Campen, F. DeClerck, B. L. Bodirsky, S. Lowder, A. Popp, R. Kanbur, O. Edenhofer, R. Nugent, J. Fanzo, S. Dietz, S. Nordhagen and S. Fan (2021). "Food system development pathways for healthy, nature-positive and inclusive food systems." Nature Food 2(12): 928-934.
Gibbons, L. V. (2020). "Regenerative—The New Sustainable?" Sustainability 12(13).
Gibbons, L. V., G. Pearthree, S. A. Cloutier and M. M. Ehlenz (2020). "The development, application, and refinement of a Regenerative Development Evaluation Tool and indicators." Ecological Indicators 108: 105698-105698.
Gkisakis, V. and D. Konstantinos (2020). "Digital innovations for the agroecological transition: A user innovation and commons-based approach." Landbauforschung 70: 1-4.
Grootaert, C. and T. Van Bastelar (2002). Understanding and Measuring Social Capital : A Multidisciplinary Tool for Practitioners. Directions in Development. Washington, DC: World Bank.
Hebinck, A., L. Klerkx, B. Elzen, K. P. W. Kok, B. König, K. Schiller, J. Tschersich, B. van Mierlo and T. von Wirth (2021). "Beyond food for thought – Directing sustainability transitions research to address fundamental change in agri-food systems." Environmental Innovation and Societal Transitions 41: 81-85.
HLPE (2019). Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
HLPE (2020). Food security and nutrition: building a global narrative towards 2030. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome.
Ifejika Speranza, C., U. Wiesmann and S. Rist (2014). "An indicator framework for assessing livelihood resilience in the context of social–ecological dynamics." Global Environmental Change 28: 109-119.

IFOAM (2020). Principles of organic agriculture. Available at: https://www.ifoam.bio/sites/default/files/2020-03/poa_english_web.pdf
IFPRI (2020). International Food Policy Research Institute. 2020 Global Food Policy Report: Building Inclusive Food Systems. Washington, DC: International Food Policy Research Institute. https://doi.org/10.2499/9780896293670.
Jacobi, J., S. Mukhovi, A. Llanque, H. Augstburger, F. Käser, C. Pozo, M. Ngutu Peter, J. M. F. Delgado, B. P. Kiteme, S. Rist and C. Ifejika Speranza (2018). "Operationalizing food system resilience: An indicator-based assessment in agroindustrial, smallholder farming, and agroecological contexts in Bolivia and Kenya." Land Use Policy 79: 433-446.
Kassam, K.-A. (2009). "Viewing Change Through the Prism of Indigenous Human Ecology: Findings from the Afghan and Tajik Pamirs." Human Ecology 37(6): 677-690.
Kemp, R., A. Arundel, C. Rammer, M. Miedzinski, C. Tapia, N. Barbieri, S. Türkeli, A. M. Bassi, M. Mazzanti, D. Chapman, F. J. Díaz López and W. McDowall (2020). "Maastricht Manual on Measuring Eco-innovation for a Green Economy."
Kizos, T., V. Detsis, T. Iosifides and M. Metaxakis (2014). "Social Capital and Social-Ecological Resilience in the Asteroussia Mountains, Southern Crete, Greece." Ecology and Society 19(1).
Leopold, A. and C. Schwartz (1968). A Sand County Almanac and Sketches Here and There. London: Oxford University Press.
Loorbach, D., N. Frantzeskaki and F. Avelino (2017). "Sustainability Transitions Research: Transforming Science and Practice for Societal Change." Annual Review of Environment and Resources 42(1): 599-626.
Loring, P. A. (2022). "Regenerative food systems and the conservation of change." Agriculture and Human Values 39: 701–713.
Mang, P. and B. Reed (2012). "Designing from place: a regenerative framework and methodology." Building Research & Information, 40(1): 23-38.
Mang, P. and B. Haggard (2020). "Regenerative development and design." In: Loftness, V. (eds) Sustainable Built Environments. Encyclopedia of Sustainability Science and Technology Series. Springer, New York, NY.
Mang, P., B. Haggard and Regensis (2016). Regenerative Development: A Framework for Evolving Sustainability, John Wiley & Sons, Ltd.
Martin, K. S., B. L. Rogers, J. T. Cook and H. M. Joseph (2004). "Social capital is associated with decreased risk of hunger." Social Science & Medicine 58(12): 2645-2654.
Maathai, W. (2010). Repleneshing the earth: Spiritual values for healing ourselves and the world. Crown Publishing Group, New York.
Mehmood, A., T. Marsden, A. Taherzadeh, L. F. Axinte and C. Rebelo (2020). "Transformative roles of people and places: learning, experiencing, and regenerative action through social innovation." Sustainability Science 15(2): 455-466.
Niles, M. T., J. Rudnick, M. Lubell and L. Cramer (2021). "Household and Community Social Capital Links to Smallholder Food Security." Frontiers in Sustainable Food Systems 5.
Nyéléni (2019). The digitalisation of the food system. Newsletter Number 37, September 2019. Available at: https://nyeleni.org/spip.php?rubrique204. 37.
Patton, M. Q. (2018). Principles-focused evaluation: the guide. The Guilford Press, New York.
Pauly, D., V. Christensen, J. Dalsgaard, R. Froese and F. Torres (1998). "Fishing Down Marine Food Webs." Science 279(5352): 860-863.
Petrosillo, I., R. Aretano and G. Zurlini (2015). "Socioecological systems." Encycl. Ecol 4: 419-425.

Plaut, J. M., B. Dunbar, A. Wackerman and S. Hodgin (2012). "Regenerative design: the LENSES Framework for buildings and communities." Building Research & Information 40(1): 112-122.

Reemer, T., S. O' Keeffe, B. De Groote, P. Murage, D. Kigiri, P. Ndambiri (2022). Collaborate to Regenerate – A facilitator guide for a team to learn from action research. A guide for facilitating. REFOOTURE document, Wageningen, Wageningen Environmental Research.

Reyers, B., C. Folke, M.-L. Moore, R. Biggs and V. Galaz (2018). "Social-Ecological Systems Insights for Navigating the Dynamics of the Anthropocene." Annual Review of Environment and Resources 43(1): 267-289.

Rodale, B. and M. Rodale (no year). Seven tendencies towards regeneration in agriculture, communities and personal spirit. Available at: https://rodaleinstitute.org/wp-content/uploads/7-TENDENCIES-REGENERATION.pdf

Salembier, C., B. Segrestin, N. Sinoir, J. Templier, B. Weil and J.-M. Meynard (2020). "Design of equipment for agroecology: Coupled innovation processes led by farmer-designers." Agricultural Systems 183: 102856.

Secco, L., et al. (2020). Evaluation Manual. Innovative methods to assess social innovation and its impacts in marginalised rural areas. SIMRA Project. Available at: www.simra-h2020.eu.

Shu-Yang, F., B. Freedman and R. Cote (2004). "Principles and practice of ecological design." Environmental Reviews 12(2): 97-112.

Steenhuijsen Piters de, B., E. Termeer, D. Bakker, H. Fonteijn and H. Brouwer (2021). "Food system resilience. Towards a joint understanding and implications for policy." Policy Paper, Wageningen University & Research.

Sundkvist, A., R. Milestad, and A. Jansson (2005). "On the importance of tightening feedback loops for sustainable development of food systems." Food Policy 30: 224–239.

Tanner, T., D. Lewis, D. Wrathall, R. Bronen, N. Cradock-Henry, S. Huq, C. Lawless, R. Nawrotzki, V. Prasad, M. A. Rahman, R. Alaniz, K. King, K. McNamara, M. Nadiruzzaman, S. Henly-Shepard and F. Thomalla (2015). "Livelihood resilience in the face of climate change." Nature Climate Change 5(1): 23-26.

Tribaldos, T. and T. Kortetmäki (2022). "Just transition principles and criteria for food systems and beyond." Environmental Innovation and Societal Transitions 43: 244-256.

Tschersich, J. and K. P. W. Kok (2022). "Deepening democracy for the governance toward just transitions in agri-food systems." Environmental Innovation and Societal Transitions 43: 358-374.

van der Ploeg, J. D. (2021). "The political economy of agroecology." The Journal of Peasant Studies 48(2): 274-297.

von Braun, J., K. Afsana, L.O. Fresco, M. Hassan, and M. Torero (2021). "Food systems - definitions, concept and application for the UN Food Systems Summit." The Scientific Group for the UN Food Systems Summit. https://sc-fss2021.org/

5.Annex

Annex I Poster that summarizes the guiding principles

Access the video

REFOOTURE
Guiding principles for Regenerative, Inclusive Food Systems

(Narratives)

Principle 1: Sense of Place and Purpose

*Regenerative, Inclusive Food Systems **start with people**, and with our unique **experience of the place** where we live. Through **caring for each other** and for **nature** in the places where we live, we can **nourish ourselves** and feel part of **a community** and of a place.*

Principle 2: Socio-Ecological Design for Innovation

These are triggered by the **needs of a community**, where farmers or other thinkers and doers in the food system, are **inspired** to find solutions and opportunities in **using the available resources and indigenous knowledge** in more **effective and creative ways**, while **working with nature** for the **collective well-being** of all.

Principle 3: Building Connections

Innovation cases creating solutions and opportunities are a **small part** of the big food system circle. In fact, the innovation cases themselves are made up of other smaller parts and of different people. But **small actions in the right direction** have the potential to have **meaningful impacts** for people and nature across the food system.

Principle 4: Fair, Just and Inclusive Transitions

In a regenerative and inclusive food system**, justice, fairness and inclusivity** are the foundations for **promoting responsibility**, **accountabilit**y and giving a **voice to all** those involved in the production and consumption of food, while at the same time **embracing and nurturing the natural environment** that supports such food systems.

Principle 5: It's a living process, design for renewal

Transitioning towards regenerative, inclusive food systems is a **living process,** it is about **continuously seeing the room** for **potential** improvements and **sowing the seeds for new ideas**, spreading those ideas wide and through this process of **learning by doing** we are regenerating the parts of the food systems to make them **work for us and for nature.**

WAGENINGEN UNIVERSITY & RESEARCH University Fund Wageningen

as of 17 March 2022

Annex II Guides to visioning according to the characteristics of RIFS

>>Questions for sense of place and purpose>>>>>>>

What makes the place unique? What are the specific resources and circumstances of that place?

What do people care about in that place? What is the relationship that people have with nature?

What are people proud of? What positively surprises other people when they come to this place?

What makes people curious? What triggers innovation?

What's the energy of the place, community like?

..The Tepi/Nakuru/South Achefer/Arua-West Nile region is known for….

Look back at sense of place and purpose for outcomes of (envisaged) innovation:

How will/do the innovation affect/benefit natural resources at district to regional levels?

Type and quality of jobs? Jobs for whom? Food and nutrition security?

Which people other than local society are/will be affected/benefited and in what way?

What is the added value that the innovation case, this collection of people brings? (For communities, nature) -how far will the knock-on effects be?

..The innovation benefits the region through….

>>Questions for socio-ecological design for innovation>>>>>>>

What practices could/will benefit the local food system (or a specifically envisaged sub-system such as spice production/processing/marketing)? Can they help to reduce the fs dependency on imports....., if there is a drought/flood – is the food system able to buffer these effects? Can you see any other potential opportunities that are currently not being explored?

What types of technologies are being considered? Do they fit the place/community?

What nature-based solutions/practices stand out? Where did this knowledge come from?

How are they financing these initiatives? Are they feasible?

How do practices/services of the innovation benefit social equity to what extent?

Through what will (farmer) incomes be boosted?

..We propose to renew the … part of the food system through ……

>>Questions for building connections>>>>>>>

How did you/LL group find out about this innovation? How is the innovation linked to other people, including people at other places? Are these people curious? How do they go about contacting others?

Is there a culture of trust and common purpose between these different people or is it more a business type relationship? (i.e. don't really like each other – but it's good for business type thing).

How will/can innovation foster people's appreciation and care for nature, feeling part of nature?

What new/better connections to other people may boost/facilitate innovation?

..Innovation will benefit from…

>>Questions for fair, just and inclusive>>>>>>>

For those involved in the innovation case, who benefits the most and how? How is it ensured that the shares of innovative practices are distributed fairly?

How does a just distribution of benefits and burdens look like?

Which people are commonly excluded for what reasons and how to bring them on board? Or is there a reason that they are excluded? Could this be handled differently?

What power relations need to be addressed to ensure equal participation? Is this something feasible to do, or is this a broader cultural issue? How could this be handled on this small scale?

Are people able to tackle the norms, are they willing to go "against the flow" if something is perceived as unjust?

How does the innovation case foster trust?

How are the interests of nature secured?

..Fair, just and inclusive co-creation will be ensured through…

>>Questions for living process>>>>>>>

What makes people confident in finding novel solutions for new challenges in the future?

What is required to spur this confidence and capacity for observing and addressing upcoming issues?

How are success stories (and failures to learn from) conserved and shared?

What is needed/will be done to install a culture of reflection and responsible adaptation?

Do people have the curiosity and the drive to keep learning and improving?

Have people a sense of how their place works i.e., they almost know when the weather will change and what they need to do to buffer the effects?

..Co-evolution will go on, since we……